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United States Patent [19]

Becker et al.

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[45] **Date of Patent: *Oct. 26, 1999**

[54] **TRENCH DRAIN**

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[73] Assignee: **Zurn Industries, Inc.**, Erie, Pa.

[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **08/850,596**

[22] Filed: **May 2, 1997**

Related U.S. Application Data

[63] Continuation-in-part of application No. 08/581,723, Dec. 29, 1995, Pat. No. 5,718,537

[60] Provisional application No. 60/017,021, May 3, 1996.

[51] **Int. Cl.**[6] **E02B 7/02**

[52] **U.S. Cl.** **405/119**; 404/2; 405/121

[58] **Field of Search** 405/118–123; 404/2, 4; 285/412; 24/543

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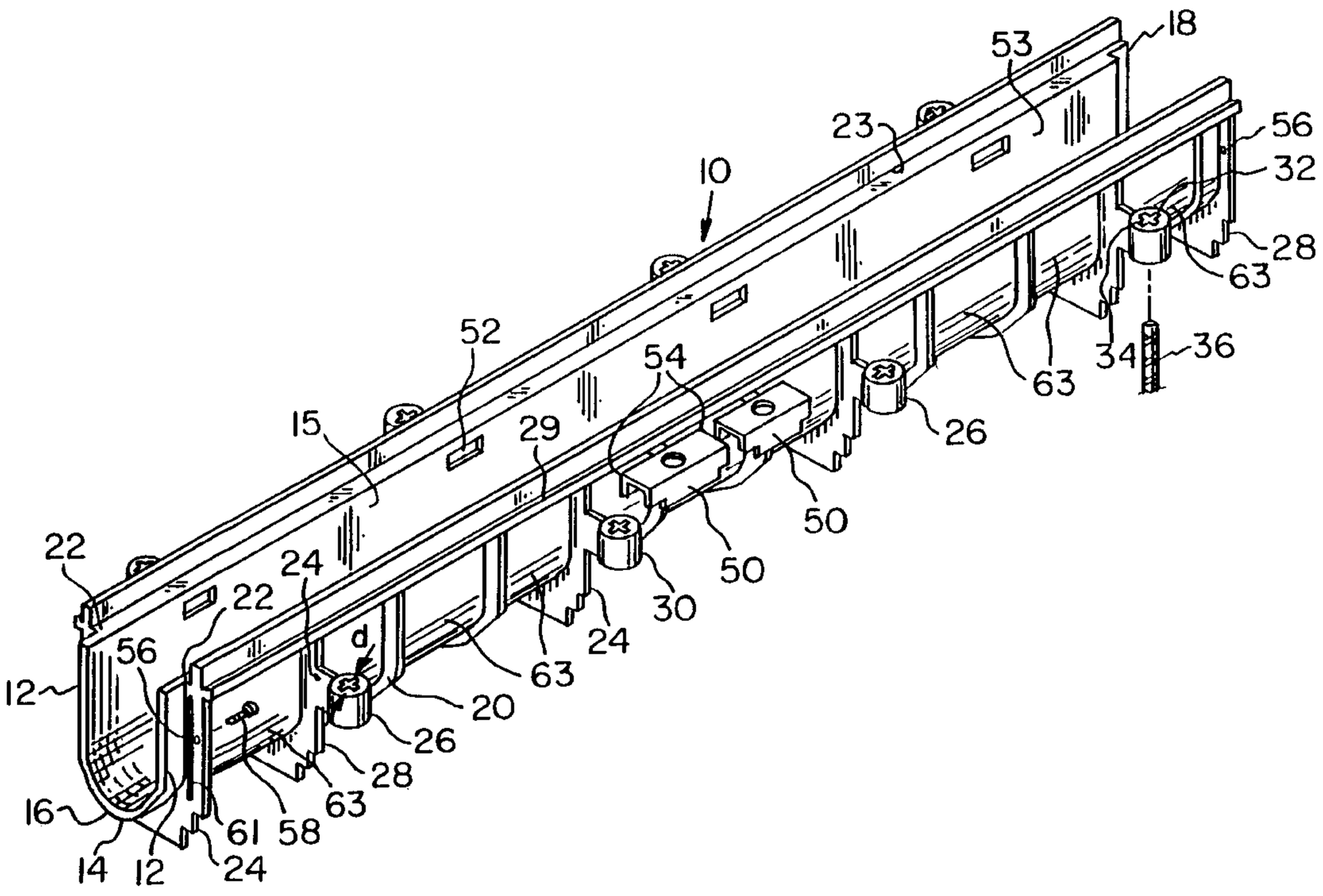
Primary Examiner—Dennis L. Taylor

Attorney, Agent, or Firm—Webb Ziesenheim Logsdon Orkin & Hanson, P.C.

[57] **ABSTRACT**

A polymeric trench drain for use in a trench drain system. The trench drain includes an open-faced channel having a crushing rib. The crushing rib prevents buckling of the trench drain due to changes in temperatures. The trench drain also includes removable spacer blocks for use during installation, which prevent the trench drain channel from deforming during installation. Rebar clips and securement clips are provided for easy installation. A unique profile is provided on support ribs to assist in easy stacking of the trench drains prior to installation.

18 Claims, 13 Drawing Sheets



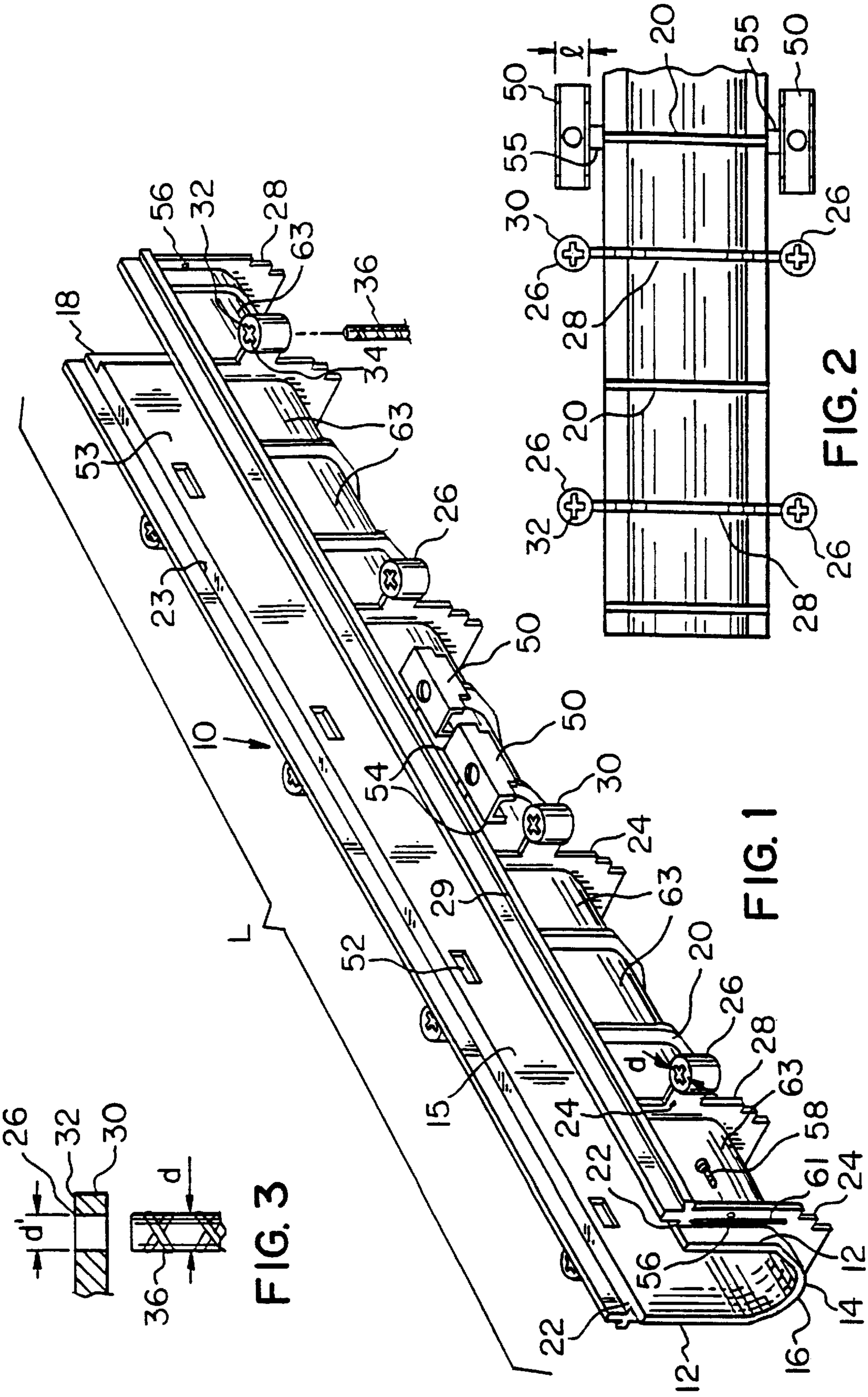


FIG. 1

FIG. 2

FIG. 3

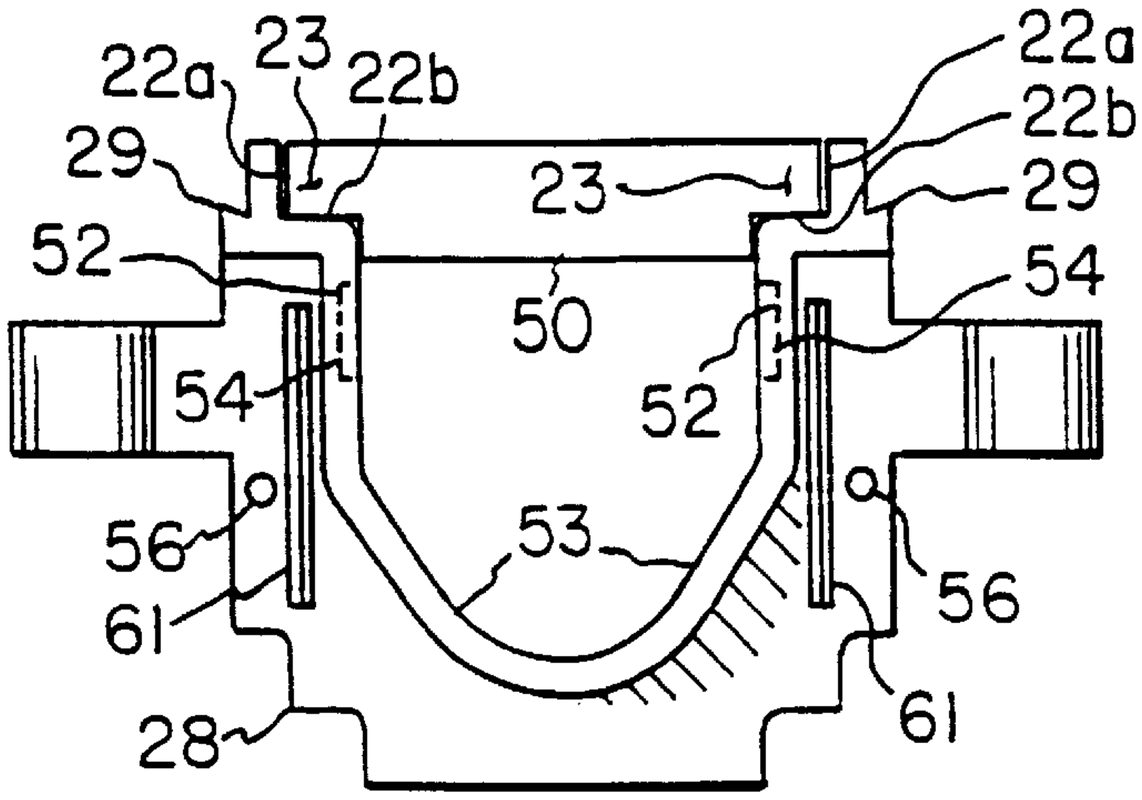


FIG. 4

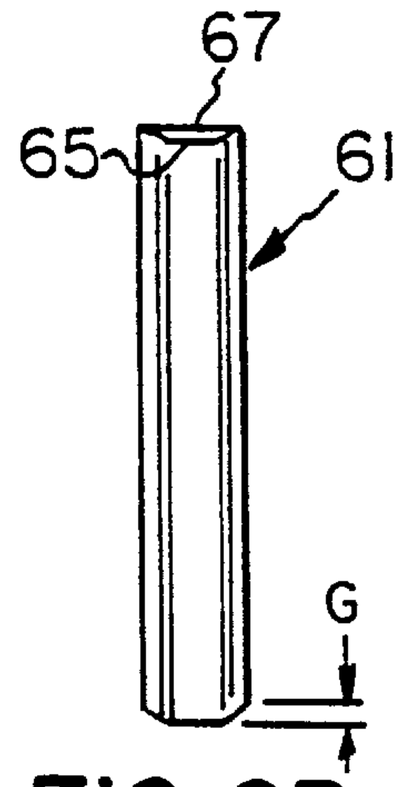


FIG. 6B

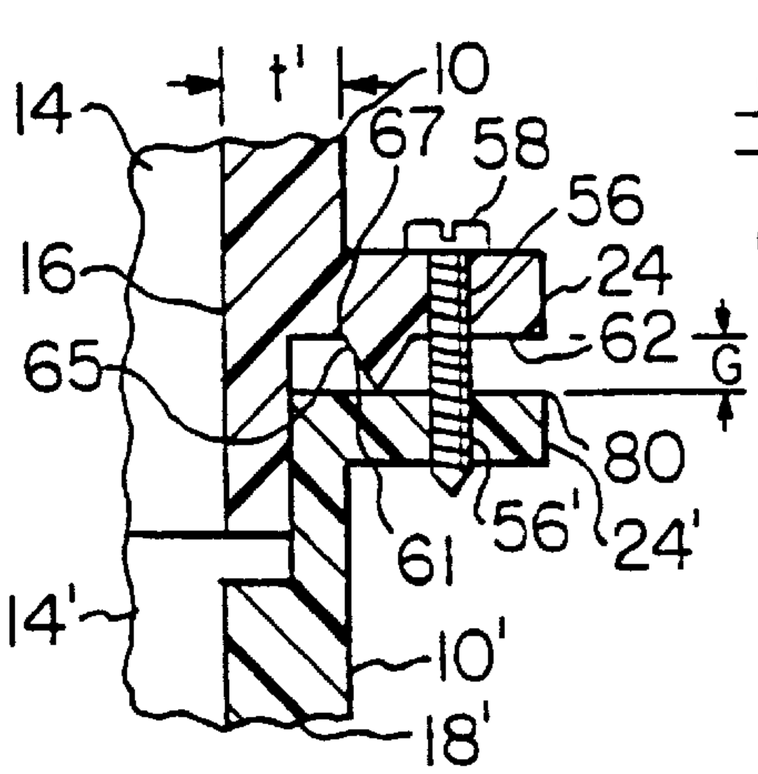


FIG. 5A

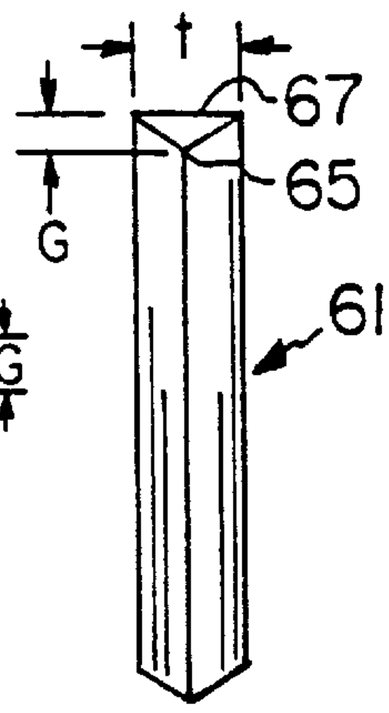


FIG. 5B

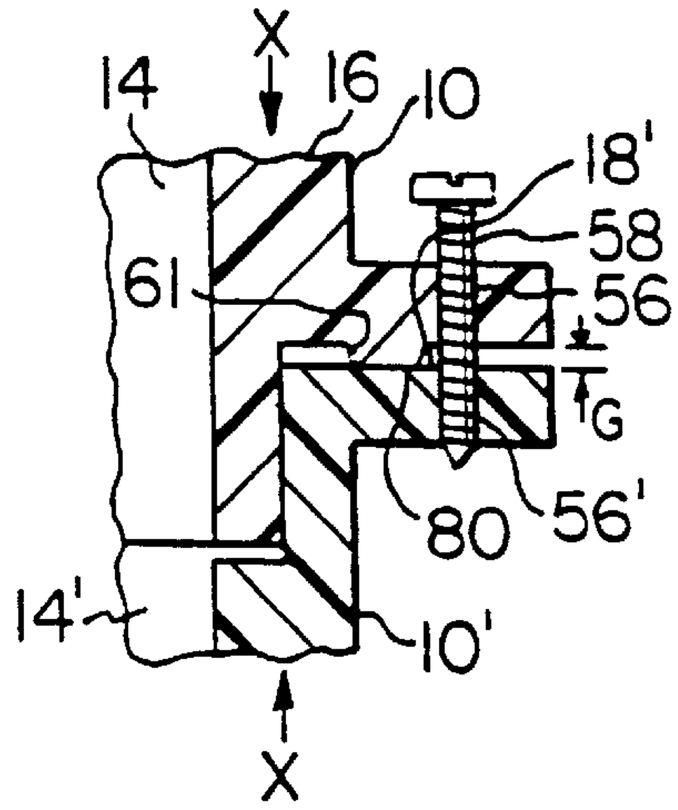


FIG. 6A

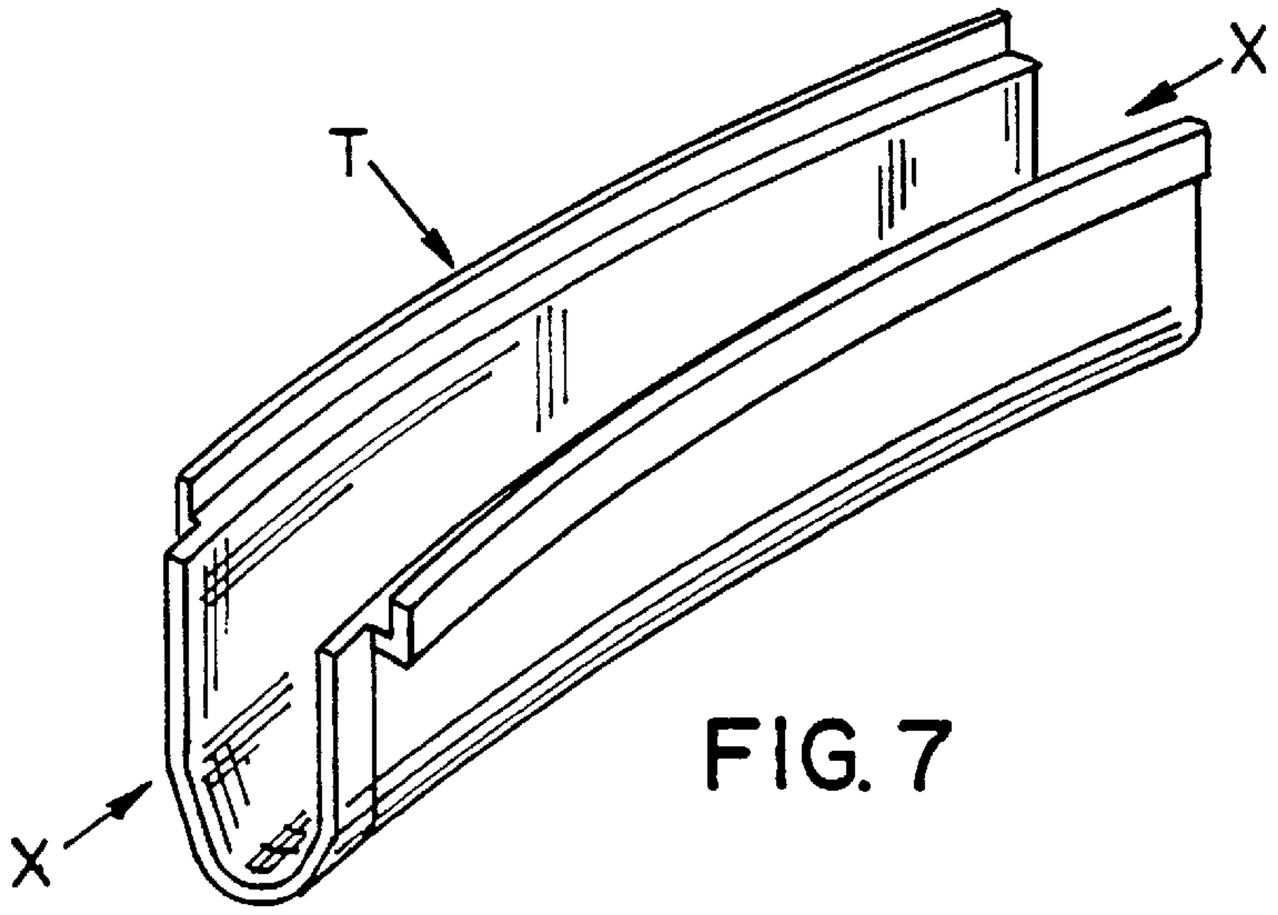


FIG. 7

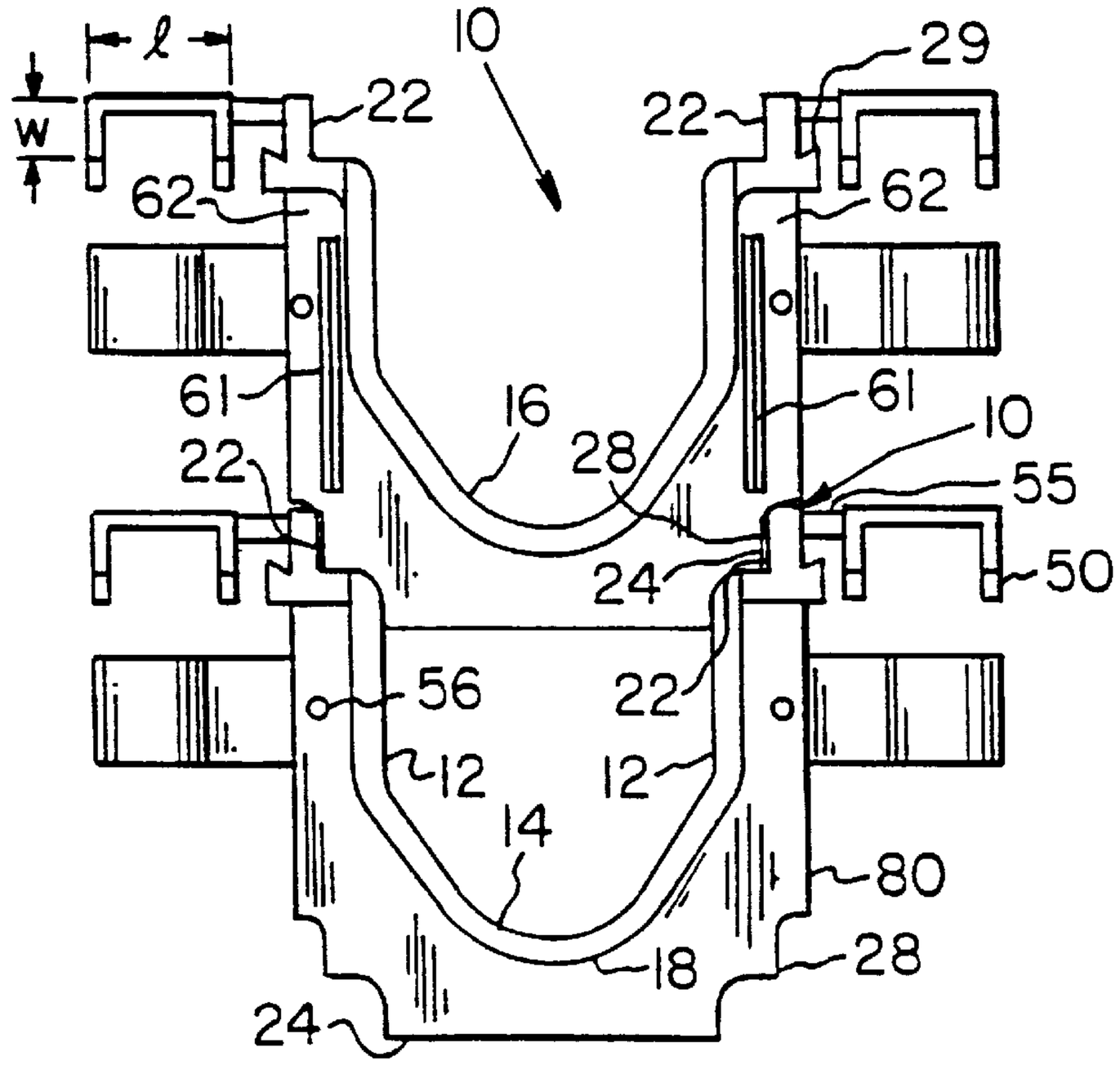

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FIG. 8

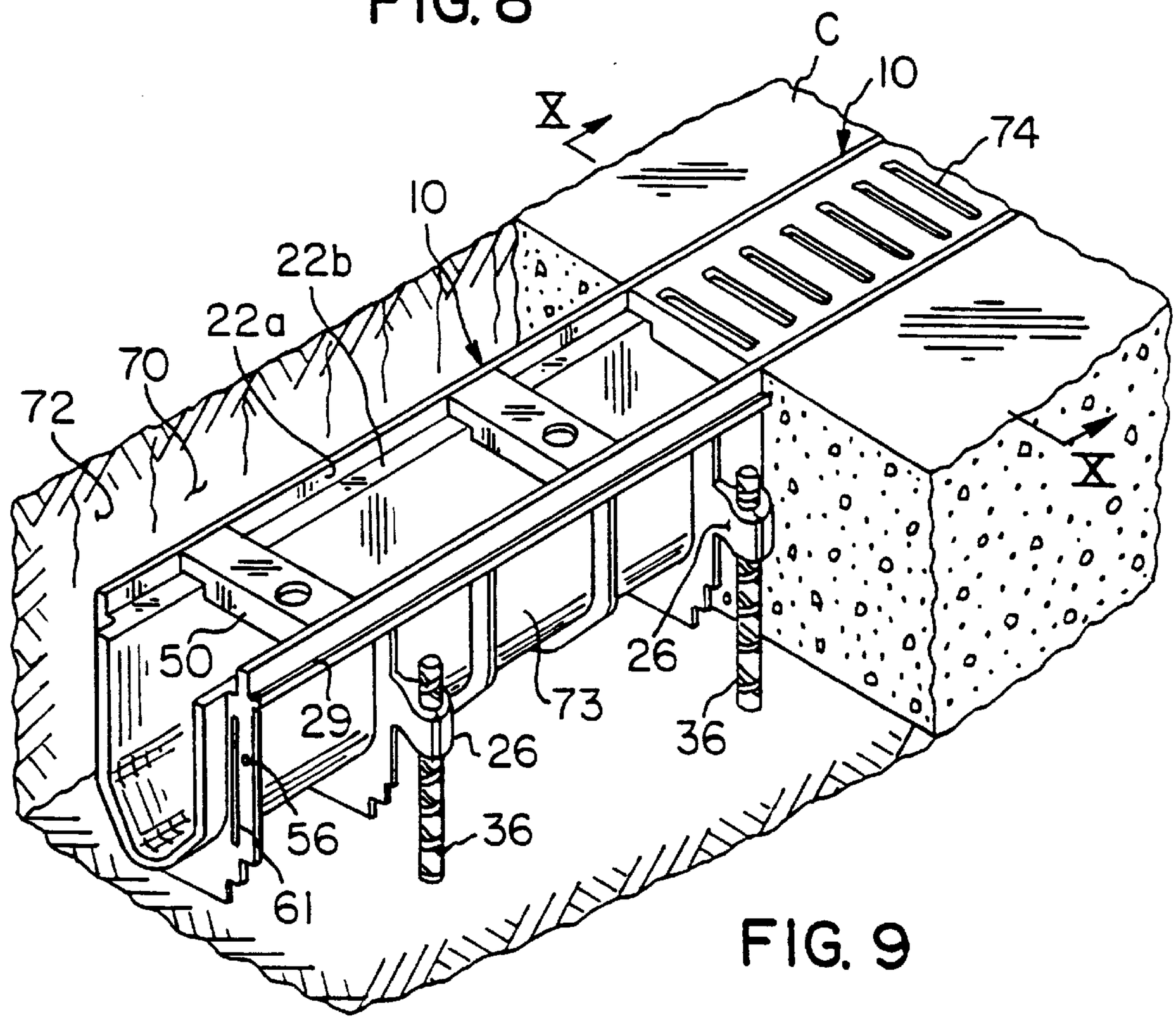
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FIG. 9

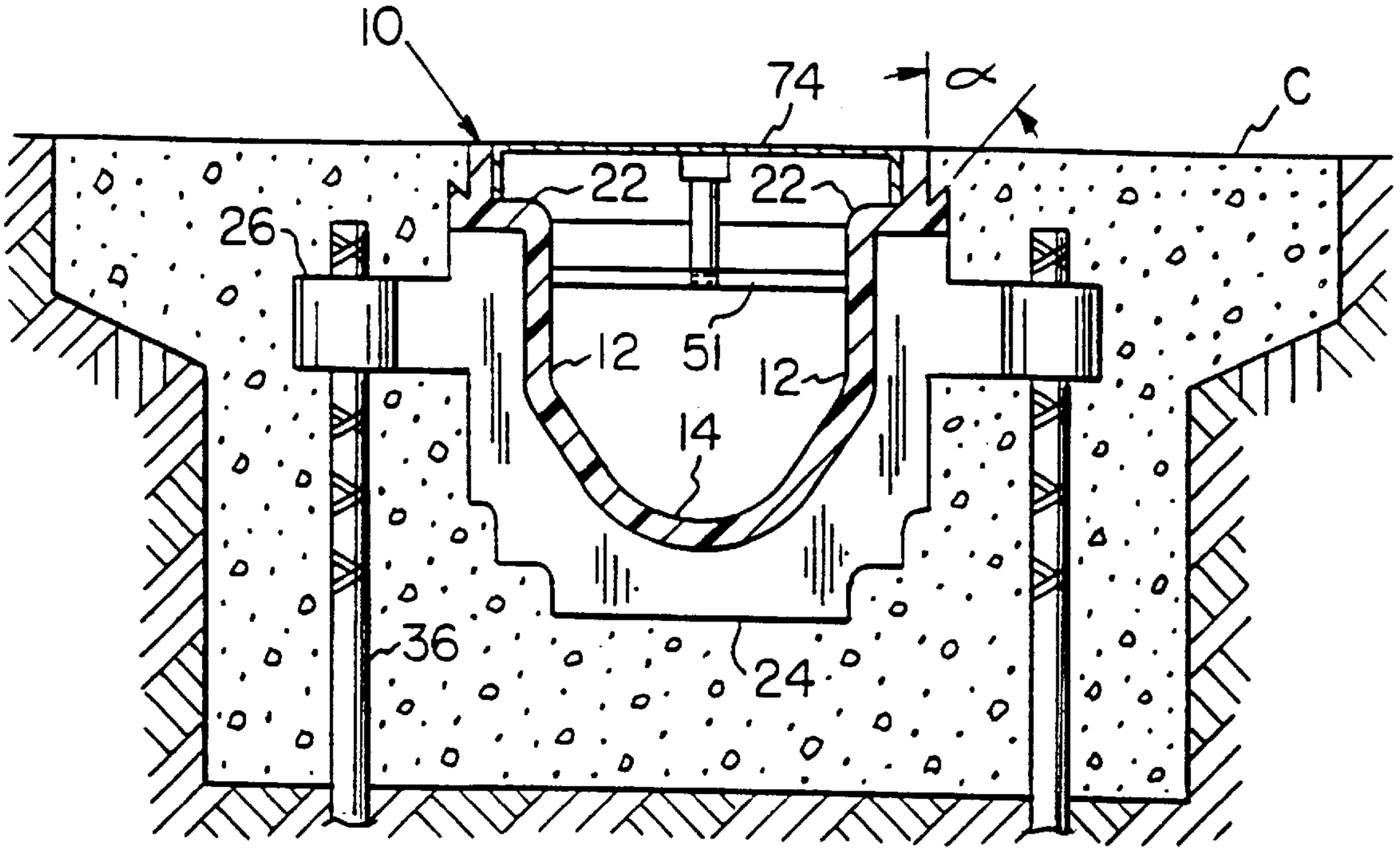
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FIG. 10

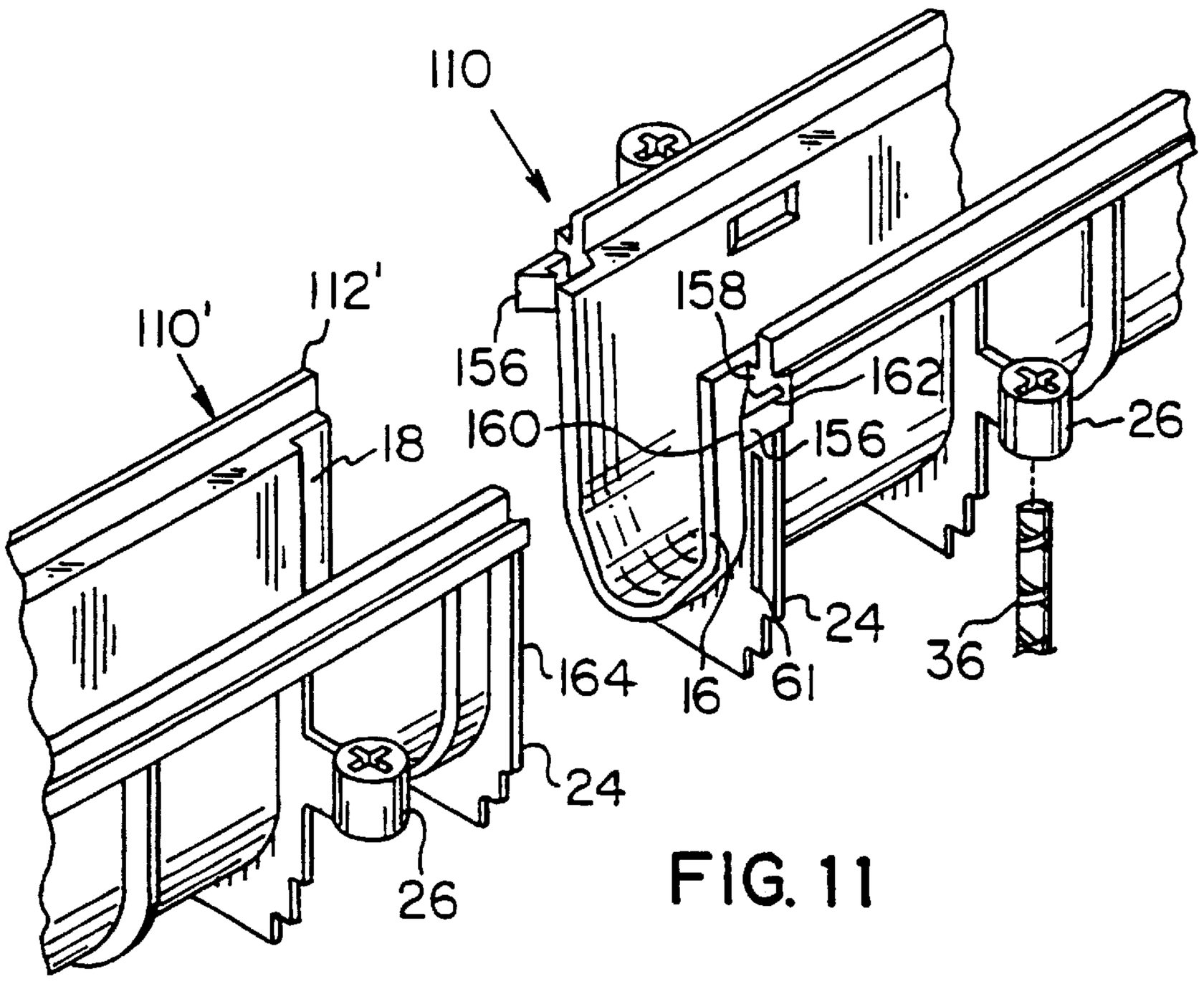
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FIG. 11

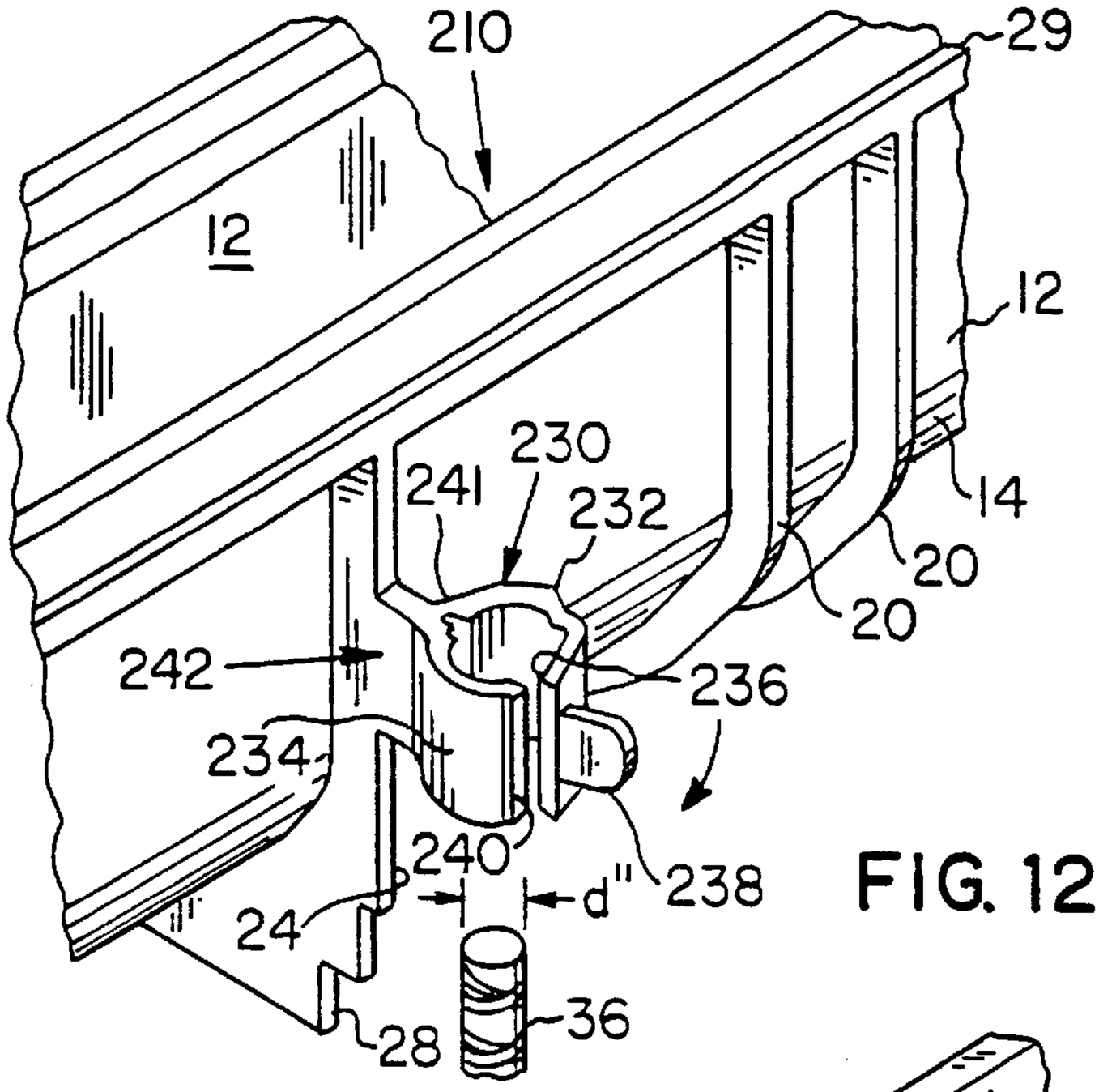
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FIG. 12

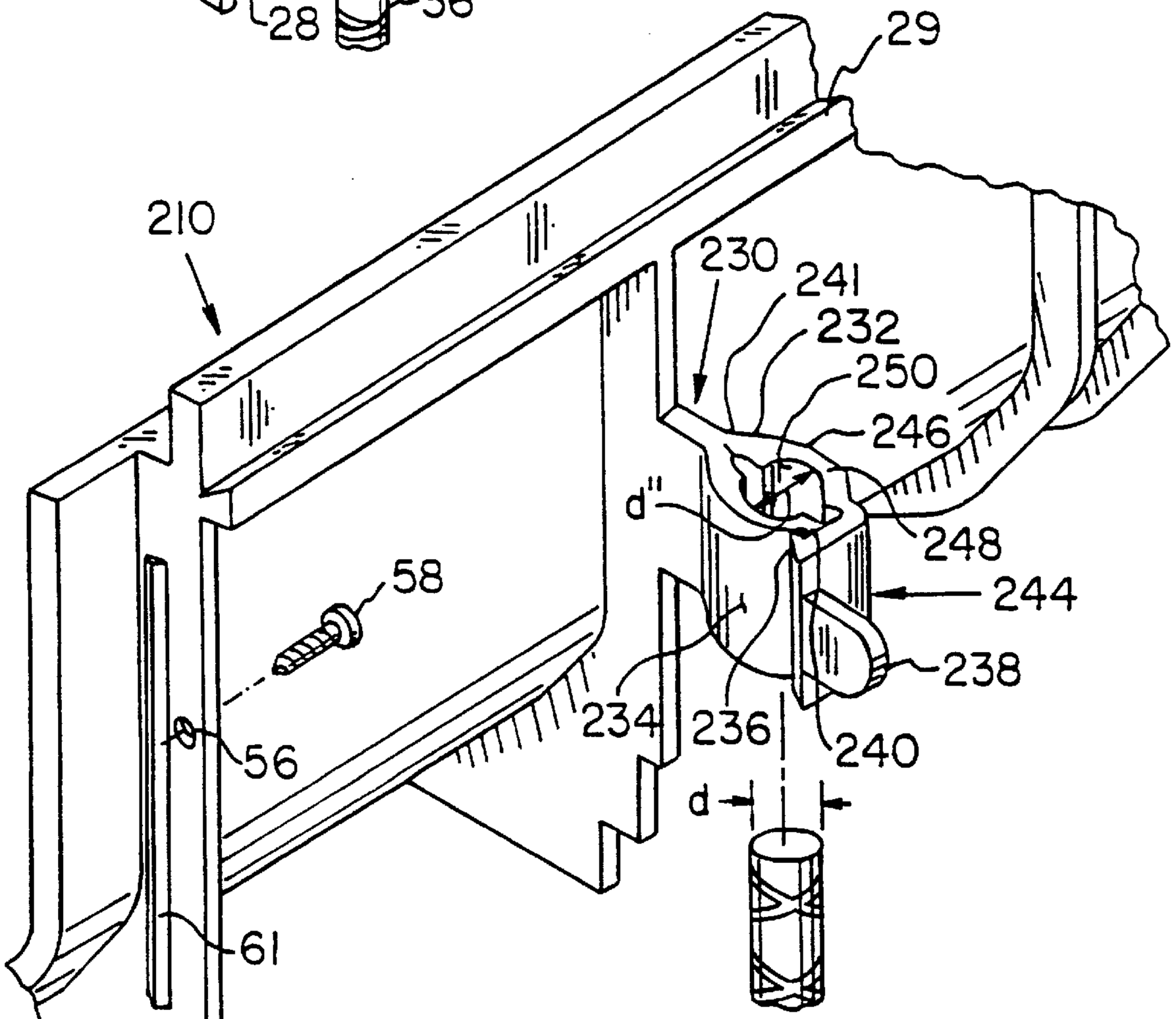
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FIG. 13

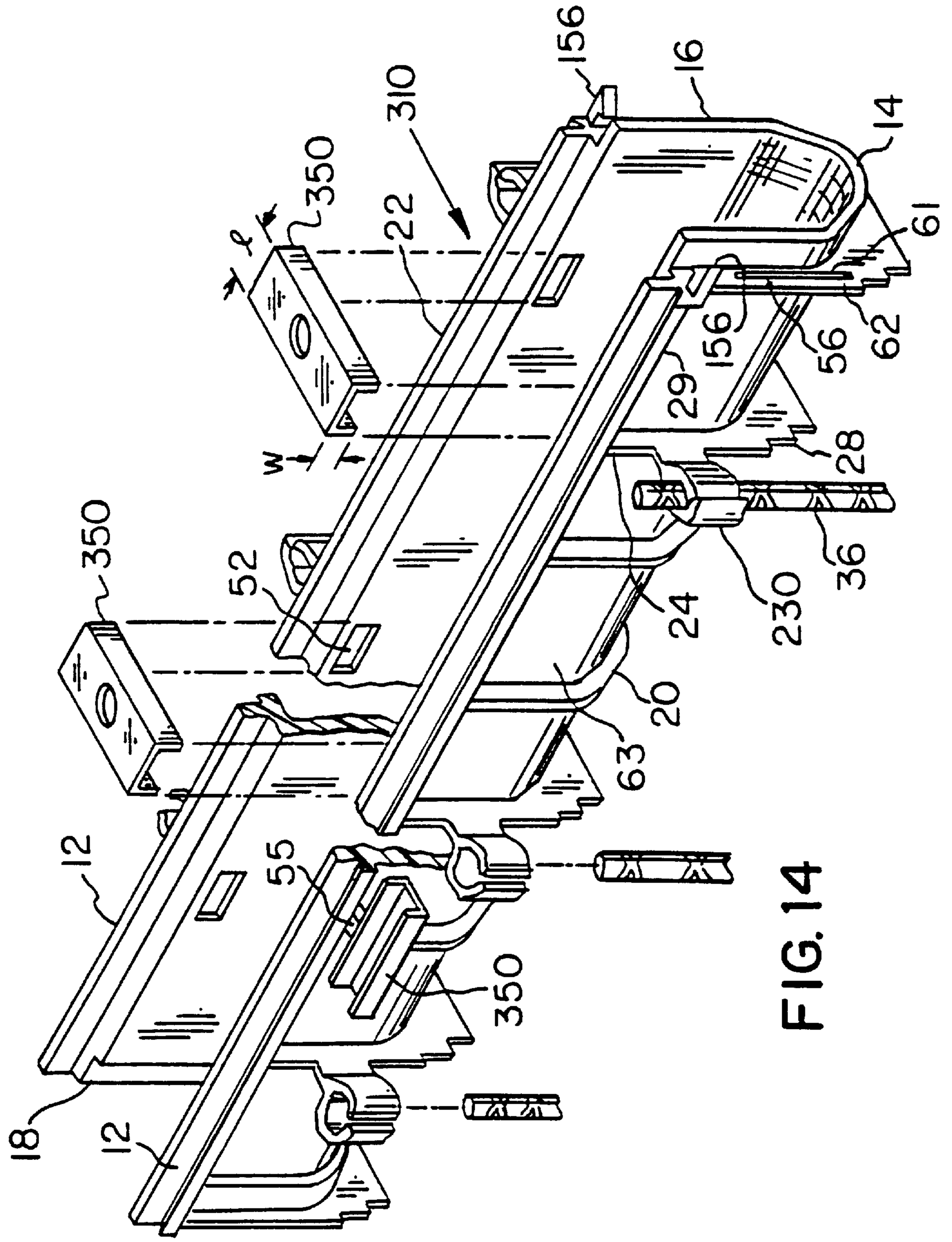
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FIG. 14

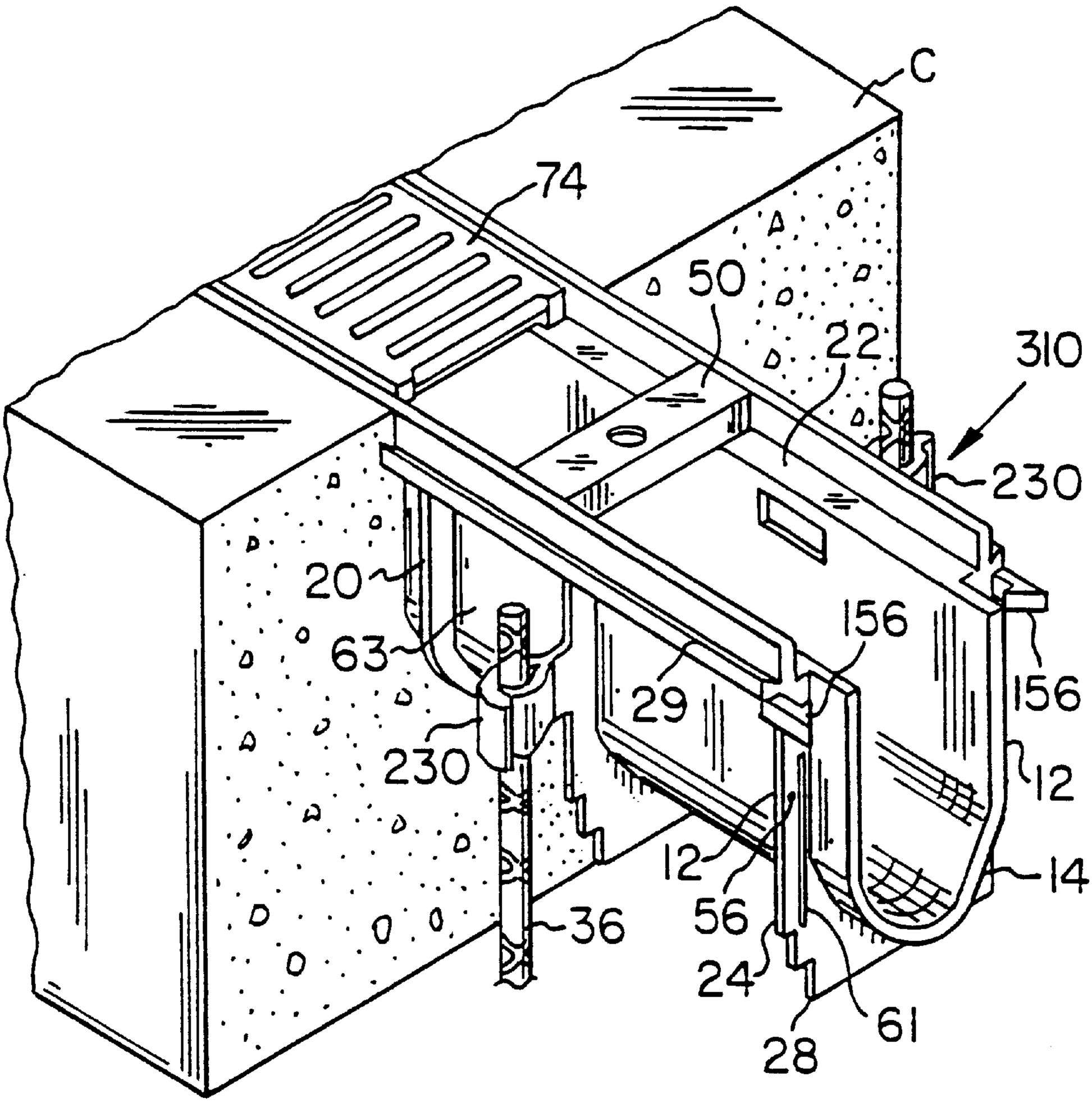

FIG. 15

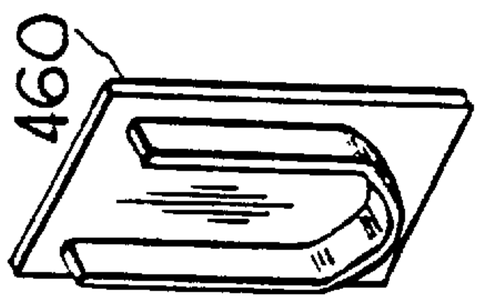

FIG. 16B

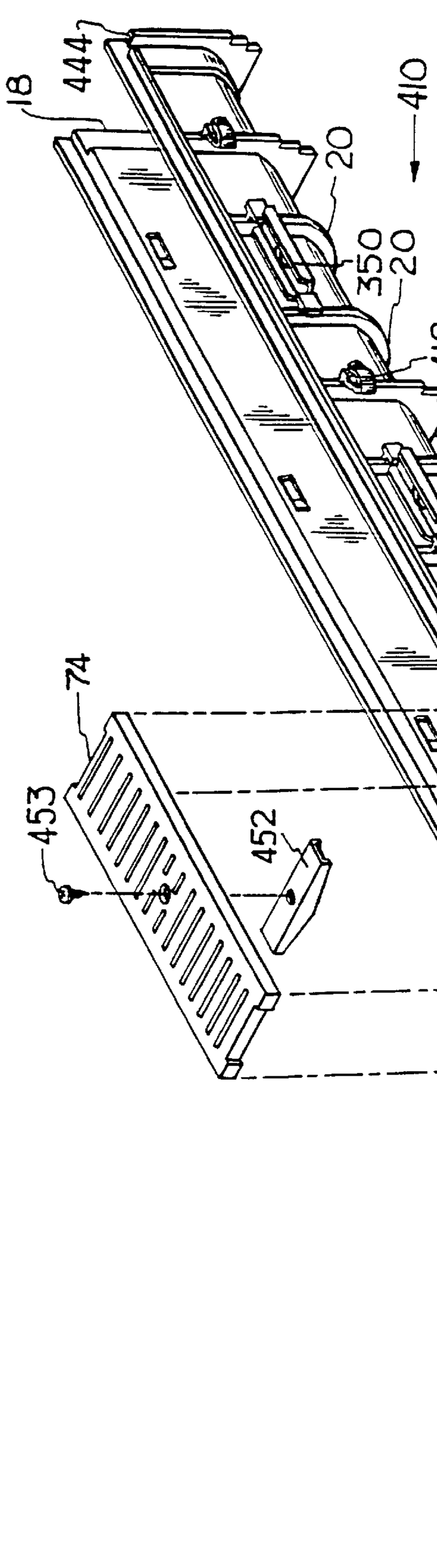

FIG. 16A

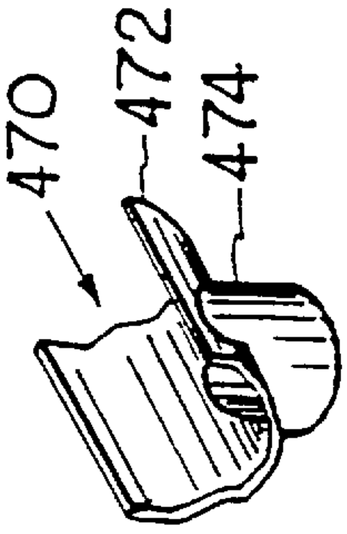

FIG. 16D

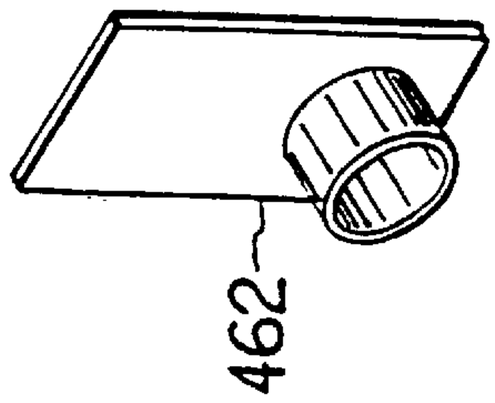

FIG. 16C

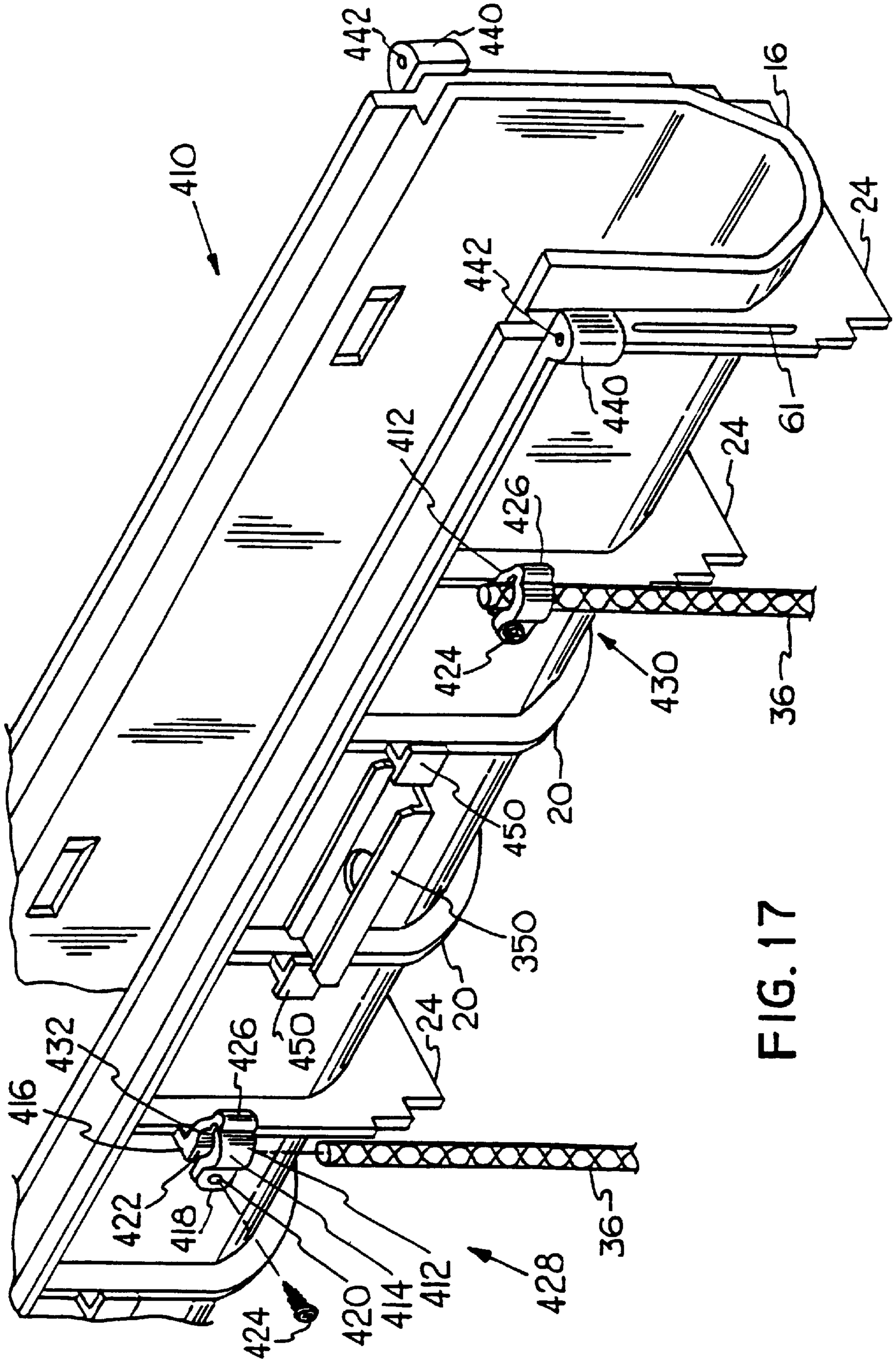
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FIG. 17

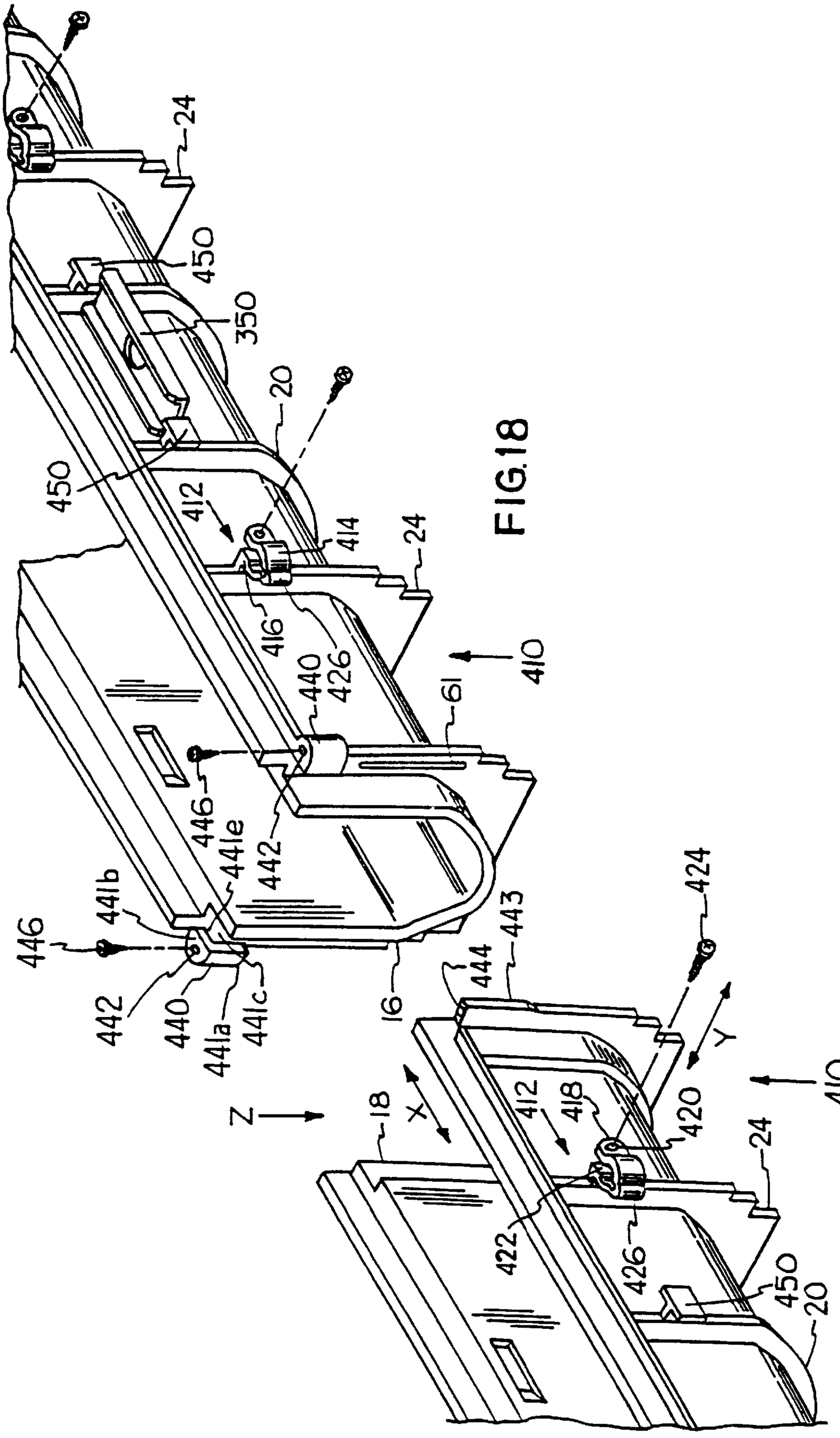
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FIG.18

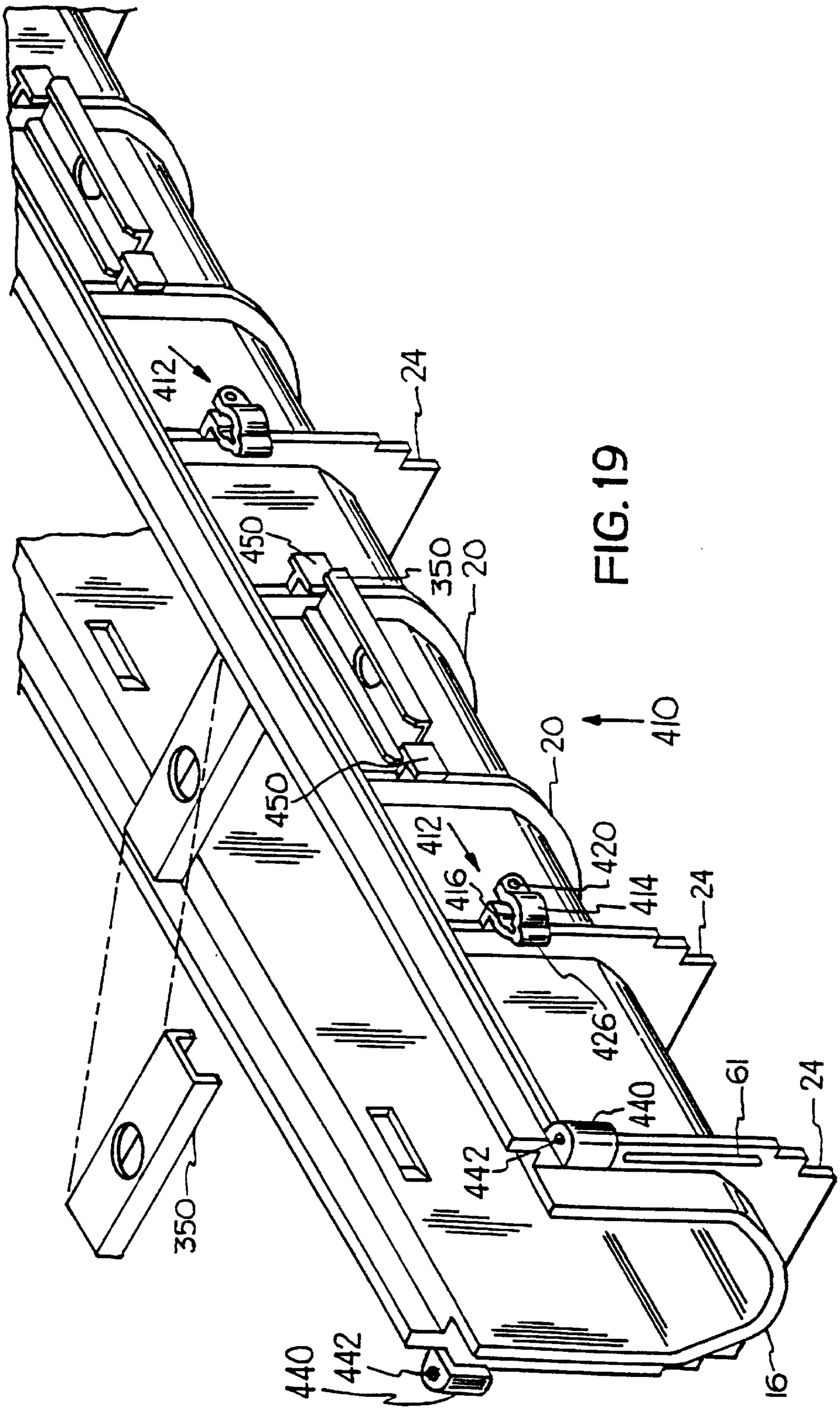
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FIG. 19

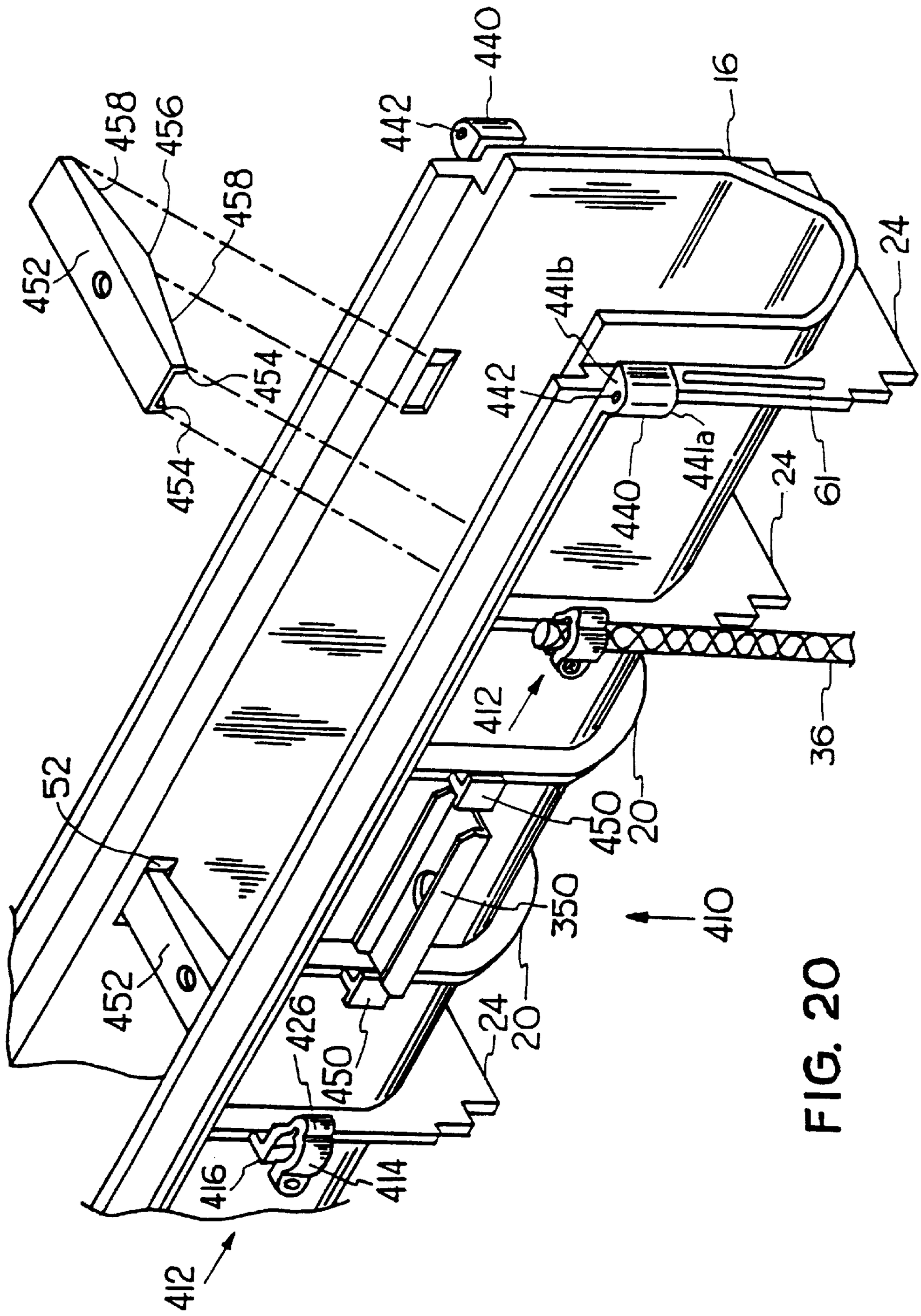
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FIG. 20

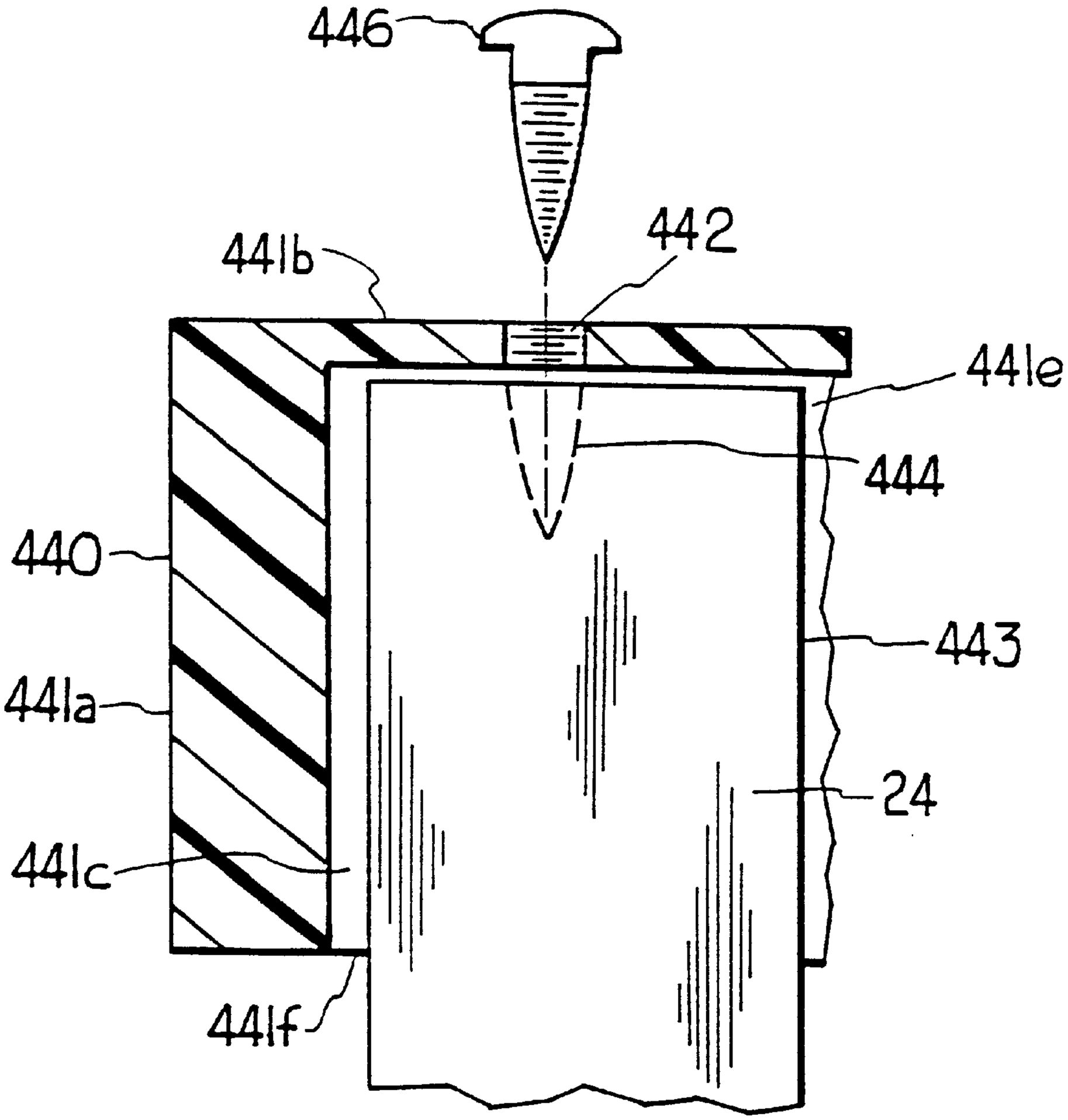

FIG. 21

TRENCH DRAIN

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of U.S. application Ser. No. 08/581,723, filed Dec. 29, 1995 now U.S. Pat. No. 5,718,537 and claims the benefit of U.S. Provisional Application Ser. No. 60/017,021, filed May 3, 1996.

BACKGROUND OF THE INVENTION

1) Field of the Invention

This invention relates generally to the field of trench drains, and more particularly, to a modular trench drain system.

2) Description of the Prior Art

The general concept of trench drains is well-known in the prior art. Trench drains are used where extensive amounts of liquid must be moved from one place to another. The trench drains typically transport the liquid to a drainage sewer. Typically, trench drains are U-shaped or V-shaped troughs and are installed adjacent to either roadways or buildings. They are installed in the ground and secured in concrete. In many cases, the trench drains include a grate to prevent large debris and people from falling into them.

Trench drain systems include several basic designs: concrete, metal and plastic. Generally, concrete trench drain systems use forms. The forms are placed in a ditch dug in the ground. Concrete is then poured around the forms, which are removed after the concrete has set, see for example, U.S. Pat. No. 4,993,878. Trench drain systems made in accordance with this method or similar methods result in relatively expensive systems due to the cost of installing and removing the forms.

U.S. Pat. No. 3,225,545 discloses a metal trench drain for use in a trench drain system. This type of trench drain results in high costs due to transportation, manufacture and installation. Also, precast concrete trench drains result in similar costs for a trench drain system.

Many of the expenses associated with these prior art trench drain systems have been overcome by the advent of polymeric trench drains, which can be left in place after the concrete has been poured in place, see U.S. Pat. No. 5,066,165. These trench drains perform two functions. First, they act as a form for the concrete; and second, they act as a liner. The manufacture and transportation costs with this type of trench drain are significantly less than the other types of trench drains.

However, trench drain systems made of polymeric trench drains have problems not associated with the other types of trench drain systems, namely buckling due to the expansion of the trench drains. This typically occurs when the trench drains are installed in colder weather. They then expand in hotter weather due to the polymeric materials' high coefficient of expansion. The embedding concrete prevents the trench drains from expanding in a longitudinal direction. Therefore, the trench drains buckle to compensate for this expansion. Further, the trench drains can deform during installation when wet concrete is poured around the periphery of the trench drains. This is due to the pressure of wet concrete against the trench drain walls.

Furthermore, as in all of the above trench drain systems, installing the polymeric trench drains require a substantial amount of hardware, i.e., nuts and bolts, which adds not only to the cost, but can also result in delays, should the installer run out of this hardware.

Therefore, it is an object of our invention to provide a polymeric trench drain which will not buckle due to temperature variations.

It is also an object of our invention to provide a trench drain system that is easy to install and transport.

It is also an object of our invention to provide a trench drain that will not deform during installation due to the pressure of wet concrete poured about the periphery of the trench drain.

It is yet another object of our invention to minimize the amount of extraneous hardware required to install the trench drains.

SUMMARY OF THE INVENTION

Our invention is a trench drain that includes an open-faced channel having spaced apart sidewalls connected to a bottom wall, where the channel includes a first end and a second end. The trench drain includes a crushing section attached to the channel, which is adapted to crush when a compressive force is applied to the channel in a longitudinal direction so as to eliminate buckling of the channel.

A clip is provided to an outer surface of one of the sidewalls for frictionally engaging with a support rod used to support the channel. The clip can be a two-piece clip.

Preferably, the first end of the trench drain includes a male section and the second end of the trench drain includes a female section adapted to matingly receive a respective male section of an adjacent trench drain. Fasteners, securement clips or connection members can be provided to secure adjacent trench drains together.

Preferably, a plurality of ribs are provided that extend from the channel, where a stacking profile is defined by a lower portion of the ribs. The stacking profile is adapted to matingly engage with a surface of another trench drain channel to permit stacking of the trench drain prior to installation.

Spacer blocks can be secured to the channel through frangible sections. The spacer blocks are then removed from the channel by breaking the frangible sections. The spacer blocks are also adapted to coact with inner surfaces of the sidewalls to prevent the sidewalls from moving toward each other.

Also, our invention is a method for forming a trench drain system having a plurality of trench drains, where each trench drain includes a spacer block connected by a frangible member to the trench drain channel. The method includes the steps of: forming an area for receiving a trench system; placing a trench drain in the area; placing a second trench drain in the area; attaching the first and second trench drains to each other; breaking the frangible members and removing the spacer blocks from the trench drains; engaging the blocks with the interior of the channels; pouring concrete around the trench drains; and removing the spacer blocks from the channels.

Another aspect of our invention is a trench drain that includes an open-faced channel and a clip. The open-faced channel includes spaced apart sidewalls connected to a bottom wall, the channel having a first end and a second end. The clip attaches to an outer surface of one of the sidewalls. The clip includes a two-piece body defined by a first section and a second section. The first section includes a tip having a fastener receiving portion, which can be a screw hole, and the second section includes a fastener engaging surface. The first section is hinged to an end of the second section. The second section is secured to the channel. The first section is

adapted to move relative to the second section so that the fastener receiving portion can align with the fastener engaging surface for a fastener (such as a screw) to pass through the tip and the fastener engaging surface to form a closed structure defining a support rod engagement surface for engaging with a support rod to support the channel.

Yet another aspect of the invention is a trench drain that includes an open-faced channel and a connection member secured to the channel. The open-faced channel includes spaced apart sidewalls connected to a bottom wall. The channel includes a first end and a second end. The connection member includes a body that defines a recess adapted to receive therein an engagement member of an adjacent trench drain in the recess. The trench drain can further include an engagement member secured to the channel adapted to be received by a connection member of an adjacent trench drain wherein the engagement member is a rib extending from the channel. Fasteners, such as screws, can be used to secure the connection member to the engagement member of an adjacent trench drain. The channel extends along a longitudinal axis, and the connection member body includes a sidewall and an upper wall that define the connection member recess. The connection member body defines a side opening and a bottom opening for receipt of the engagement member defined by a portion of a laterally extending rib of the adjacent trench drain into the recess.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top perspective view of a trench drain made in accordance with the present invention;

FIG. **2** is a bottom plan view of a portion of the trench drain shown in FIG. **1**;

FIG. **3** is a partial sectional side view of a rebar clip of the trench drain;

FIG. **4** is a front elevational view of the trench drain having an installed spacer block made in accordance with the present invention;

FIG. **5**A is a partial top sectional view of portions of the two adjacent trench drains made in accordance with the present invention, showing an uncrushed crushing rib;

FIG. **5**B is a top perspective view of the uncrushed crushing rib shown in FIG. **5**A;

FIG. **6**A is a partial top sectional view similar to that of FIG. **5**A, showing a crushed crushing rib;

FIG. **6**B is a top perspective view of the crushed crushing rib shown in FIG. **6**A;

FIG. **7** is a top perspective view of a buckled trench drain;

FIG. **8** is a front elevational view of two stacked trench drains made in accordance with the present invention;

FIG. **9** is a top perspective view of the trench drain shown in FIG. **4** that is partially installed in a trench;

FIG. **10** shows a section taken along lines X—X of FIG. **9**;

FIG. **11** is an exploded top perspective view of portions of two adjacent trench drains made in accordance with a second embodiment of the present invention;

FIG. **12** is a top perspective view of a portion of a trench drain made in accordance with a third embodiment of the present invention, having a rebar clip in an open position;

FIG. **13** is an exploded top perspective view of a portion of the trench drain shown in FIG. **12**, where the rebar clip is in a closed position;

FIG. **14** is a top perspective view of a fourth embodiment of a trench drain made in accordance with the present invention;

FIG. **15** is a top perspective view of the trench drain shown in FIG. **14** that is partially installed;

FIG. **16**A is a top perspective view of a fifth embodiment of a trench drain made in accordance with the present invention;

FIG. **16**B is a top perspective view of a closed end plate used with a trench drain;

FIG. **16**C is a top perspective view of an outlet end plate used with a trench drain;

FIG. **16**D is a top perspective view of an outlet attachment used with a trench drain;

FIG. **17** is a partially exploded top perspective view of a portion of the trench drain shown in FIG. **16**A having rebars secured thereto;

FIG. **18** is an exploded top perspective portion of two adjacent trench drains made in accordance to the trench drain shown in FIG. **16**A;

FIG. **19** is an exploded top perspective view of a portion of the trench drain shown in FIG. **16**A;

FIG. **20** is a partially exploded top perspective view of a portion of the trench drain shown in FIG. **16**A with an engaged cross member; and

FIG. **21** is a partially exploded sectional elevational view of two adjacent trench drains.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. **1** and **2** show a V-shaped trench drain **10** made in accordance with the present invention. The trench drain **10** includes spaced apart sidewalls **12** connected to a V-shaped bottom wall **14** and define an open-faced channel **15**. Sidewalls **12** can either be straight or angled. Likewise, bottom wall **14** can either be flat or angled so that water or other liquids can be directed from one end to another.

The trench drain **10** includes a first end or male end **16** and a second end or female end **18**. The male end **16** includes a portion of the walls **12** and **14** and the female end **18** defines a recessed portion adapted to matingly receive a male end **16** of an adjacent trench drain. A plurality of ribs **20** are integrally formed in the walls **12** and **14** and are spaced along the length of the trench drain **10**. The ribs **20** add structural strength to the trench drain **10**. A plurality of support ribs **24** are also integrally formed in the walls **12** and **14** and are spaced along the length of the trench drain **10**. Support ribs **24** include a lower section **28** defining a stacking profile. An L-shaped lip **22** is defined at upper ends of respective sidewalls **12**. Lips **22** define recesses **23** for receiving a grate. Seepage lips **29** extend along outer surfaces of sidewalls **12** near the upper ends of the sidewalls **12**. An upper surface of each seepage lip **29** is angled an angle a (approximately 45°) as shown in FIG. **10**.

Rebar clips **26** are integrally formed on opposite sides of many of the support ribs **24**, and are positioned adjacent an outer surface of the sidewall **12**. As shown in FIGS. **1**–**3**, each rebar clip **26** includes a rebar clip body **30** having a rebar clip engagement surface **32**. The rebar clip engagement surface **32** defines an annular hole **34** passing therethrough. As shown in FIG. **3**, the rebar clip hole **34** has a diameter "d'" that is less than the diameter "d" of the supporting rebar **36**. The supporting rebar **36** is used to support the trench drain **10** in a trench as will be explained below.

Referring back to FIGS. **1** and **2**, a plurality (four) of U-shaped spacer blocks **50** are integrally secured to outer surfaces of sidewalls **12**. Any number of spacer blocks can

be provided such as one, two or twelve, for example. The spacer blocks **50** are adapted to be received between lips **22** as shown in FIG. **9**. Recesses **52** are spaced directly apart from each other on opposite sidewalls **12** for receipt of steel cross members **51** adapted to receive a bolt for securing a grate to the trench drain **10**. Four sets of recesses are defined per trench drain **10**.

Each spacer block **50** is U-shaped and has a base portion with two legs depending therefrom. Each end **54** has a length "l" and width "w" dimensions adapted to be received by a lip **22** such that the ends **54** can be removably received by the lips **22**. A frangible section **55** secures each spacer block **50** to the respective sidewall **12**. The frangible section **55** will break when a breaking force is applied to the spacer block **50** by an installer so that the spacer block can be removed from the trench drain **10**. As shown in FIG. **4**, the removed spacer blocks' ends **54** are adapted to be placed onto the lips **22**.

Referring to FIGS. **1** and **4**, screw holes **56** are defined within the support ribs **24** adjacent the male end **16** and female end **18**. Screws **58** are adapted to pass through these respective holes during assembly so as to fasten adjacent male and female ends **16** and **18** of respective trench drains **10**.

A plurality of trench drain panel portions **63** are defined between ribs **20** and **24**. The trench drain panel portions **63** include contiguous sections of walls **12** and **14**. The trench drain also includes a crushing rib or section **61** attached to the channel **15**. The crushing rib **61** is defined on a face **62** of the support rib **24** adjacent the sidewalls **12** of the male end **16**. As can be seen from FIGS. **5**A and **5**B, prior to crushing, the crushing rib has a triangular cross section with an apex portion **65** and a base portion **67**. The thickness "t" of the base portion **67** is preferably approximately 3⁄32 inches or one quarter of the thickness "t'" of the trench drain panel portions **63**. Referring now to FIGS. **6**A and **6**B, in this arrangement crushing rib **61** will crush when a compressive force is applied to the trench drain **10** in a longitudinal direction "X" prior to the buckling of a trench drain "T" as shown in FIG. **7**.

Preferably, trench drain **10** is made of a polymeric or plastic material, such as a resin containing fiberglass, nylon, or a polyethylene and formed in lengths eighty inches. Trench drain **10** weighs considerably less than a comparable concrete or metal trench drain. In general, more polymeric trench drains can be transported per truckload than concrete or metal trench drains because of their light weight.

Other polymeric trench drains, such as that disclosed in U.S. Pat. No. 5,066,165, have problems as far as being able to stack a plurality of these trenches in a row. As shown in FIG. **8**, support ribs **24** overcome this problem. Each support rib lower section **28** includes the stacking profile. As can be seen in FIGS. **1**, **2** and **8**, each side of support rib lower section **28** includes a stepped portion which corresponds to a profile of an outer surface of a respective lip **22**. As specifically shown in FIG. **8**, the sides of support rib lower section **28** matingly engage with respective portions of lips **22** of an adjacent trench drain **10**, when two or more trench drains are stacked on top of each other for transporting or storage. The trench drains **10** can then be easily unstacked.

Referring to FIGS. **9** and **10**, the installation of the trench drain system will be discussed. First, a trench **70** is dug in the ground **72** defining an area for receiving a plurality of trench drains. Then, a plurality of trench drains **10** are positioned adjacent to each other. A plurality of spaced rebar support rods **36** are secured to the ground **72** and positioned adjacent to respective rebar clips **26**. Each rebar clip **26** receives one of the rods **36** so that the trench drains **10** are attached thereto. The trench drain **10** is held in place by frictional engagement of the rebar clip engagement surfaces **32** with the outer surfaces of the respective rod **36**. The bottom of the trench drain **10** is positioned a distance "Y" above the bottom of the trench **70**. This distance "Y" can easily be adjusted by forcing the clips **26** up or down the rod **36**. Adjacent ends **16** and **18** are received by respective trench drains **10** such as shown in FIG. **5**A. In this manner, screw holes **56** of the adjacent trench drains **10** are coaxially aligned. The screws **58** pass through and threadably engage the adjacent supporting ribs **24** so as to secure the adjacent trench drains **10** to each other. In this arrangement, the apex **65** of the crushing ribs **61** abut a face **80** of a support rib adjacent the female end **18**. FIGS. **5**A and **6**A use primed numbers to indicate an adjacent trench drain **10'** connected to trench drain **10**.

The installer then breaks the frangible sections **55** and removes the spacer blocks **50** from the trench drain sidewalls **12**. The installer then places the spacer blocks **50** onto the lips **22** as previously described so as to engage the spacer blocks **50** with the inner surfaces of the sidewalls **12**. Specifically, edges of the spacer block ends **54** contact the lip surfaces **22***a* and **22***b*. Concrete "C" is then poured in the trench **70** in a space defined between the outer surfaces **73** of the trench drains **10** so as to embed the trench drain **10** in concrete. The pressure of the wet concrete forces the sidewalls **12** to deflect toward each other. This causes the spacer block ends **54** to abut against and coact with the inner surfaces of the lips **22**, thereby preventing the sidewalls **12** from continuing to deflect toward each other. This results in substantially uniformly spaced apart sidewalls **12** from trench drain to trench drain. Hence, the spacer blocks **50** solve the wall deflection problem with the prior art plastic or polymeric trench drains. After the concrete hardens or sets, the spacer blocks **50** are removed and discarded, thereby resulting in a trench drain system formed by a plurality of trench drains **10**. Finally, a grate **74** can be removably received by the lips **22** and secured to the trenches through the cross members **51** received within recesses **52**. The seepage lips **29** collect water that seeps between the upper surface of the lip/concrete interface. Holes can be drilled in the lip so as to fluidly communicate the seepage lip with the interior of the trench drain **10**. Also, the angled seepage lip assists in securing the trench drain **10** into the concrete.

As previously discussed, buckling is a common problem that exists in present polymeric trench drains. The buckling occurs due to the high coefficient of expansion of the polymeric materials as compared to concrete and cast iron. The buckling problem is not noticeable when the trench drains are installed during the winter months in a cold climate (such as in temperature of 32° F.). Preferably, adjacent trench drains **10** abut each other when initially installed as shown in FIG. **5**A. A gap "G", which is equal to the height of the crushing rib as measured from the apex **65** to the base **67**, is defined between the adjacent support ribs **24** and **24'**. However, as the temperature increases during the summer months (say to 90° F. or higher), the length "L" of the trench drains increases. The trench drains are prevented from expanding too much because they are embedded in concrete. This then causes the trench drains **10** to become subject to internal compressive forces and could normally cause the trench drains **10** to buckle, such as shown in FIG. **7**. The crushing ribs **61** overcome this problem. The crushing ribs **61** have a wall thickness substantially less than the wall thickness of the remainder of the trench drain. Hence, when

the trench drain begins to expand in the longitudinal direction due to an increase in temperature, the crush ribs **61** will crush and flatten the apex due to compressive forces between face **80** and the crush rib **61** as shown in FIGS. **6**A and **6**B relieving the compressive forces which can cause buckling. Hence, the crushing of the ribs **61** prevents buckling of the trench drain **10** due to these compressive forces. The gap "G" becomes smaller as the crushing rib **61** compresses and the distance between apex **65** and the base **67** becomes smaller. Although crushing ribs **61** are shown adjacent the male end **16** and not on the female end **18**, the crushing ribs **61** could be positioned adjacent the female end **18** and not on the male end **16**. Alternatively, the crushing ribs **61** can be positioned on both the female end and male end.

FIG. **11** shows a second embodiment of a trench drain **110** made in accordance with the present invention. Trench drain **110** is similar to trench drain **10**; and therefore, only the differences will be described and like reference numerals will be used to describe like parts. The trench drain **110** includes two spaced apart securement clips **156**, in lieu of the screws **58** and screw holes **56** of trench drain **10**. The securement clips **156** are positioned on opposite sides of the trench drain **110**.

Each securement clip **156** is integrally attached to the support rib **24** adjacent the male end **16** of trench drain **110**. Each securement clip **156** includes a recess **158** defined by an angled tip **160** and a flexing body **162**. Engagement members on surfaces **164** are defined on the support rib **24** adjacent the female end **18** of the trench drain **110**. Only one of the engagement surfaces **164** is shown in FIG. **11**. The other engagement surface is positioned on the opposite side of the support rib **24** of trench drain **110'** adjacent the sidewall **112'**. Essentially, the engagement surfaces **164** are defined by a portion of the support rib **24**. In operation, the male end **16** matingly engages with the female end **18** of adjacent trench drains **110** and **110'** so that the angled tips **160** are urged outwardly by the engagement surfaces **164** during installation. Once the male end **16** abuts against an abutting surface, the engagement surfaces **164** are received within the recesses **158**. This causes the securement clips **156** to move toward each other and lockingly engage the engagement surfaces **164** with the securement clips **156** so that the adjacent trench drains **110** and **110'** are secured to each other. The adjacent trench drains **110** and **110'** can be disengaged by urging the securement clips **156** away from each other so that the adjacent trench drains **110** and **110'** can be pulled away from each other.

FIGS. **12** and **13** show a third embodiment of a trench drain **210**. Trench drain **210** is similar to trench drain **10**, except for the below noted differences. Like reference numerals will be used for like elements. Referring to FIG. **12**, trench drain **210** includes two-piece rebar clips **230**, in lieu of the unitary rebar clips **26**. Only one of the rebar clips **230** is shown. Each rebar clip **230** is integrally formed on or secured to the support rib **24** of the trench drain **210**. Each rebar clip **230** includes a first section **232** and a second section **234**. An angled tip **236** is defined at an end of the first section **232** and an outwardly extending tab **238** is integrally formed on an outer portion of first section **232**. An engagement surface **240** is defined on an end of the second section **234** and is adapted to engage with tip **236**. A living hinge **241** secures the first section **232** to the support rib **24** so that said first section **232** can be moved relative to the second section **234**.

FIG. **12** shows the rebar clip **230** in an unengaged position **242** so that the trench drain rebar clip **230** can slidably receive the rebar **36**. The spacing between the first section **232** and second section **234** is such that the rebar clip **230** cannot hold the trench drain **210** to the rebar **36**. FIG. **13** shows the rebar clip **230** in an engaged position **244**, whereby the tip **236** abuts against the engagement surface **240** forming a closed structure. The tab **238** permits the installer to pull the tip **236** from the unengaged position **242** to the engaged position **244** after the rebar clip **230** is positioned on the rebar **36**. The engaged rebar clip **230** includes a rebar clip body engagement surface **248**, which defines a rebar clip hole **250** when the rebar clip **230** is in the engaged position **244**. The diameter "d"" of the rebar clip hole **250** is less than the diameter "d" of the rebar **36**. The rebar clip body engagement surface **248** frictionally engages with the outer surface of the rebar **36** when the rebar clip is in the engaged position. The position of the trench drain **210** on the rebar **36** can be adjusted by disengaging the rebar clip **230**. This is accomplished by having the operator pull tab **238** so as to cause disengagement of the tip **236** from the engagement surface **240**. Once the trench drain **210** is repositioned, the rebar clips **230** can be reengaged.

The rebar clips **26** and **230** replace the prior art arrangements for securing trench drains to rebar or other posts, namely the need for extra hardware. Likewise, securement clip **156** replaces the need of extra screws **58** to secure adjacent trenches and other arrangements of prior art trenches. The support ribs permit easy storage and stacking and transport of the trench drains. Further, the spacer blocks **50** prevent the trench drain walls from deforming during installation. Hence, the above-described trench drains **10**, **110** and **210** overcome many of the problems of prior art trench drains.

FIGS. **14** and **15** show a fourth embodiment of a trench drain **310** made in accordance with the present invention, which includes many of the features previously discussed. Like references will be used for like elements. Trench drains **310** include a securement clip **156** and rebar clips **230**. Spacer blocks **350** are provided that are similar to spacer blocks **50**. Spacer blocks **350** are U-shaped and include a base portion and two legs and are secured to the sidewalls **12** by frangible sections **55**. Each end **354** has a length "l" and width "w", such that spacer blocks **350** can be removably received by lips **22**, in the same manner as spacer blocks **50**.

FIGS. **16**A–**21** show a fifth embodiment of a trench drain **410** made in accordance with the present invention. Trench drain **410** is similar to trench drain **10** except for the below noted differences. Like reference numerals will be used for like elements. Referring to FIGS. **16**A and **17**–**20**, trench drain **410** includes two-piece rebar clips **412** in lieu of the unitary rebar clips **26**. Rebar clips **412** are attached to an outer surface of the trench drain channel sidewalls. Referring to FIGS. **17** and **18**, each rebar clip **412** is integrally formed on or secured to a support rib **24** of trench drain **410**. Each rebar clip **412** includes a first section **414** and a second section **416**. Tip **418** is defined at an end of the first section **414** having a screw receiving portion that defines screw hole **420**. A screw engaging surface **422** is defined on an end of the second section **416** and is adapted to receive a screw **424**. A living hinge **426** secures an end of the first section **414** to the second section **416** so that the tip **418** of the first section **414** can be aligned relative to the screw engaging surface **422** of the second section **416**. In this arrangement, the first section **414** can move relative to the second section **416**. An end of the second section **416** is secured to rib **24**.

FIG. **17** shows the rebar clip **412** in an unengaged position **428** so that the rebar clip **412** can slidably receive the rebar **36**. The spacing between the first section **414** and the second

section **416** is such that the rebar clip **412** cannot hold the trench drain **410** to the rebar **36**. FIG. **17** also shows the rebar clip **412** in an engaged position **430**, whereby the tip **418** is aligned with the screw engaging surface **422**. When screw **424** is inserted through screw hole **420** and is screwed into the screw engaging surface **422**, a closed structure around the rebar is formed. The rebar clip **412** includes a rebar clip internal body engagement surface **432**, which defines a rebar clip hole when the rebar clip **412** is in the engaged position **430**. The rebar clip internal body engagement surface **432** frictionally engages with the outer surface of the rebar **36** when the rebar clip **412** is in the engaged position **430**. The position of the trench drain **410** on the rebar **36** can be adjusted by loosening or removing the screw **424**, thereby disengaging the rebar clip **412**, and then tightening the screw when the trench drain is appropriately positioned.

As shown in FIGS. **18** and **21**, trench drain **410** also includes two overlap connection members **440** integrally formed on or secured to the support rib **24** adjacent the male end **16**. Each connection member **440** includes an arcuate sidewall **441***a* and an upper wall **441***b*. As shown in FIG. **21**, a recess **441***c* is defined by sidewall **441***a* and upper wall **441***b*. A side opening **441***e* is defined by walls **441***a* and **441***b* and a bottom opening **441***f* is defined by wall **441***a*. The overlap connection members **440** have a screw hole **442** defined in wall **441***b*. Overlap connection members **440** are formed to overlap a portion **443** of the laterally extending support rib **24'**, defined on the female end **18** of the adjacent section of the trench drain **410**. By laterally extending, it is meant that the ribs extend along a Y axis that is normal to an X axis which the trench drain channel extends, as shown in FIG. **18**. Specifically, each portion **443** of support rib **24'** is received within recess **441***c*. Support rib **24'**, adjacent the female end **18**, includes two oppositely positioned pilot screw holes **444** (of which only one is shown) that are positioned on upper surfaces of support rib **24'** and configured to be aligned with the screw holes **442** of the connection members **440** when the portions **443** are received within respective recesses **441***c*. (Alternatively, overlap connection members **440** can be provided on the female end **18** and portions **443** can be provided on the male end **16**.) Assembly of the male end **16** and the female end **18** of two individual sections of trench drain **410** requires that overlap connection members **440** be placed over the support rib **24'** adjacent the female end **18** so that portions **443** (which form engagement members for overlap connection members **440**) are received in recesses **441***c* and the screws **446** pass through respective screw holes **442** and **444** to secure the two adjacent trench drains. The overlap connection members **440** and portions **443** permit easy alignment of adjacent trench drains **410**. Furthermore, easy installation of adjacent trench drains **410** can be accomplished because the connection members **440** are engaged by placing the overlap connection members **440** above portions **443** and then lower overlap connection members **440** in the "Z" direction until they engage with portions **443**. The screws **446** can then be tightened by an installer who is positioned above the trench drains **410**. This can be substantially easier than moving adjacent drains sideways to engage securement clip **156** or screws **58** when there is little room to maneuver in the trenches.

As shown in FIG. **19**, trench drain **410** also includes spacer blocks **350** having ends secured to ribs **20** by two frangible sections **450**, as opposed to a single frangible section **55** as shown in FIG. **14**. FIG. **20** shows cross members **452**, which are similar to cross members **51** as shown in FIG. **10**, having two legs **454** extending downward from a central portion forming a U-shape. Each leg **454** is wider at its middle **456** than at its ends **458**. Cross member **452** is received in recesses **52**. Each cross member **452** has a threaded hole defined in the central portion adapted to threadably receive a threaded fastener **453** that secures the grate **74** to the cross member **452**.

FIGS. **16**B and **16**C show a closed end **460** and an outlet end **462** each being configured to be attached to either the male end **16** or the female end **18** of the trench drain **410**. FIG. **16**D shows an outlet attachment **470** having an upper section **472** and a lower section **474**. The lower section **474** is in the form of a tube which can be inserted over a cutout (not shown) in the bottom wall **14** of the trench drain **410**. The upper section **472** is shaped to form fit outside the trench drain **410** to aid in sealing the cutout (not shown). Although crushing ribs **61** are shown, the trench drain **410** can be manufactured without the crushing ribs **61**.

Finally, it is preferable that the crushing ribs, securement clips, rebar clips and spacer blocks be integrally formed with the trench drain channel **15** in one molding process. However, it is possible to attach the clips and spacer blocks to the channel **15** after it is formed or molded. The various features of each embodiment can also be combined with other embodiments or substituted therefor.

Having described the presently preferred embodiments of our invention, it is to be understood that it may otherwise be embodied within the scope of the appended claims.

We claim:

1. A trench drain comprising:

an open-faced channel having spaced apart sidewalls connected to a bottom wall, said channel having a first end and a second end; and

a clip integrally formed on an outer surface of one of said sidewalls, said clip having a two-piece body defined by a first section and a second section, said first section including a tip defining a screw hole and said second section including a fastener engaging surface, said first section hinged to an end of said second section, and said second section secured to said channel, said first section adapted to move relative to said second section so that said screw hole can align with said fastener engaging surface for a screw to pass through said tip and said fastener engaging surface to form a closed structure defining a support rod engagement surface for engaging with a support rod to support said channel.

2. A trench drain as claimed in claim **1**, further comprising a crushing section defined in said channel, said crushing section adapted to crush when a compressive force is applied to the channel in a longitudinal direction so as to prevent buckling of said channel due to the compressive force.

3. A trench drain as claimed in claim **1**, wherein said first end includes a male section and said second end includes a female section, said female section adapted to matingly receive a respective male section of an adjacent trench drain.

4. A trench drain as claimed in claim **1**, further comprising means for securing two adjacent trench drains together.

5. A trench drain as claimed in claim **4**, wherein said means for securing two adjacent trench drains together comprises a connection member having a body portion adapted to overlap a portion of an adjacent trench drain.

6. A trench drain as claimed in claim **5**, wherein said connection member body defines a recess adapted to receive therein an engagement member of an adjacent trench drain in said recess.

7. A trench drain as claimed in claim **6**, wherein said engagement member is a rib extending from said channel adjacent to said female section.

8. A trench drain as claimed in claim 6, further comprising fasteners for securing said connection member to the engagement member of an adjacent trench drain.

9. A trench drain as claimed in claim 1, further comprising a plurality of ribs extending from said channel.

10. A trench drain as claimed in claim 9, further comprising a stacking profile defined by a lower portion of said ribs, said stacking profile adapted to matingly engage with a surface of another trench drain channel to permit stacking of said trench drain prior to installation.

11. A trench drain as claimed in claim 10, wherein said channel includes a lip extending from each of said sidewalls, said lips being spaced apart and adapted to receive a grate, said stacking profile including stepped portions adapted to matingly engage with surfaces of said lips.

12. A trench drain as claimed in claim 1, further comprising a spacer block secured to said channel.

13. A trench drain as claimed in claim 1, wherein said spacer block is secured to said channel by a frangible section, said spacer block is removed from said channel by breaking said frangible section and is adapted to coact with inner surfaces of said sidewalls to prevent said sidewalls from moving toward each other.

14. A trench drain as claimed in claim 13, wherein said spacer block includes a base and two legs depending from said base.

15. A trench drain as claimed in claim 1, wherein said channel comprises a polymeric material.

16. A trench drain comprising:

an open-faced channel having spaced apart sidewalls connected to a bottom wall, said channel having a first end and a second end;

a connection member having a body that defines a recess adapted to receive therein an engagement member of an adjacent trench drain in said recess, said connection member secured to said channel;

wherein said channel extends along a longitudinal axis and said connection member body comprises a sidewall and an upper wall that define the connection member recess, said connection member body defining a side opening and a bottom opening for receipt of the engagement member defined by a portion of a laterally extending rib of the adjacent trench drain into the recess; and

an engagement member secured to said channel adapted to be received by a connection member of an adjacent trench drain, wherein said engagement member is a rib extending from said channel.

17. A trench drain as claimed in claim 16, further comprising fasteners for securing said connection member to the engagement member of an adjacent trench drain.

18. A trench drain as claimed in claim 17, wherein said fasteners are received by an upper surface of said engagement member.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,971,662
DATED : October 26, 1999
INVENTOR(S) : Allen R. Becker et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 1 Lines 43-44 "5,066," and "165" should read --5,066,165 --.

Column 4 Lines 52-53 "angle a" should read --angle α--.

Signed and Sealed this

Sixteenth Day of May, 2000

Attest:

Q. TODD DICKINSON

Attesting Officer

Director of Patents and Trademarks